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With one Appendix

Oothrix borealis n. sp.
a bottom-dwelling Copepod from Northern Norway

By
Kristian Fredrik Wiborg

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INTRODUCTION.

The investigations on the food of cod (*Gadus callarias* L.) have hitherto largely been carried out on cod of marketable size from commercial catches, (for literature see BROWN and CHENG 1946) and little has been done concerning the food of cod during its first year of life. The present author has previously (1948) given a preliminary report on the food of cod of the 0—II group from shallow and deep water.

MATERIAL.

Samples of cod, mainly of the 0-group, some also of the I—II groups were taken with a prawn trawl in deep water along the coast of Northern Norway during the years 1946—49. (For localities see chart, fig. 1).

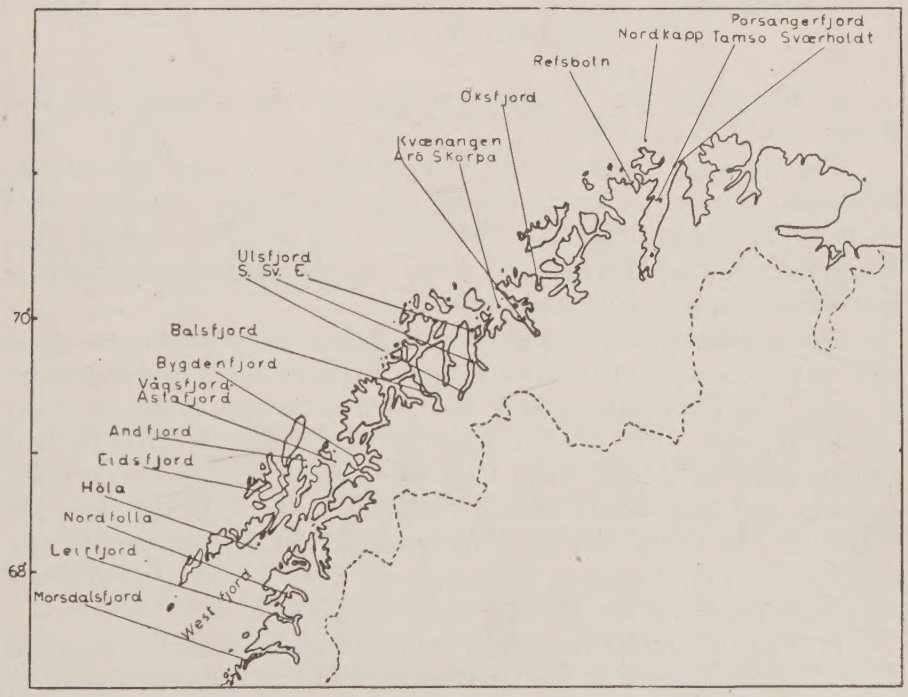

Fig. 1. Localities in Northern Norway where cod of the 0—II-groups have been taken in deep water during 1946—1948.

Most of the material has been collected in the months August—November, but single samples were also taken in March (1948) and May (1949). A total of 2310 stomachs have been investigated, 2115 stomachs from the 0-group and 195 stomachs from the I—II groups.

METHODS.

The cod were collected mainly for the purpose of vertebrae counts, and had been preserved in formalin, 4—10 %, containing some NaCl. During the working up of the material the stomachs were removed and kept for a later investigation. In the material from 1946 and 1948 each stomach was examined individually in order to investigate the frequency of the food organisms. Otherwise the stomachs from each locality were examined en bloc.

All food organisms were determined and counted as far as possible. After the counts the volume of the stomach contents from each locality was measured. The number of empty stomachs was as a rule noted, with the exception of those stomachs which had been turned inside out.

TABLES AND FIGURES.

In the preparation of tables and figures I have largely followed Brown and Cheng (1946).

The different species of food organisms have been grouped as Decapoda, Mysidacea, Euphausiacea, etc. Number of organisms and volume of stomach contents are estimated per 10 feeding fish. Whenever possible, number and frequency of food organisms in the individual stomachs have been calculated.

The organisms will be of different food value according to their size. For that reason I have tried to measure the different food organisms in units. The Euphausiacea have been used as the unit, as they are most commonly met with. The Decapoda, Mysidacea, Polychaeta and Chaetognatha have been found to be of approximately the same order of size as the Euphausiacea, while 5 Amphipoda or Isopoda, 100 Copepoda Calanoida and 1000 Copepoda Harpacticoida will roughly balance one euphausiid. Fish found in the stomachs have a size corresponding to 5 euphausiids, on one occasion to 25 euphausiids.

It must be stressed that these are rough calculations only intended to give an impression of the relations between the different species of food organisms. The grouping is indicated in the figures but the actual number of the different food organisms found is also shown.

THE FOOD OF COD OF THE 0—II GROUPS FROM DEEP WATER IN DIFFERENT LOCALITIES ALONG THE COAST OF NORTHERN NORWAY.

The relative composition of the stomach contents of cod of the 0-group from the Lofoten area is shown in fig. 2.

Decapoda, mainly *Pandalus borealis*, occur frequently, but in small numbers. In Morsdalsfjord they were of some importance in March 1948. In addition to *Pandalus*, *Pontophilus norvegicus* and *Sabinea sarsi* were found.

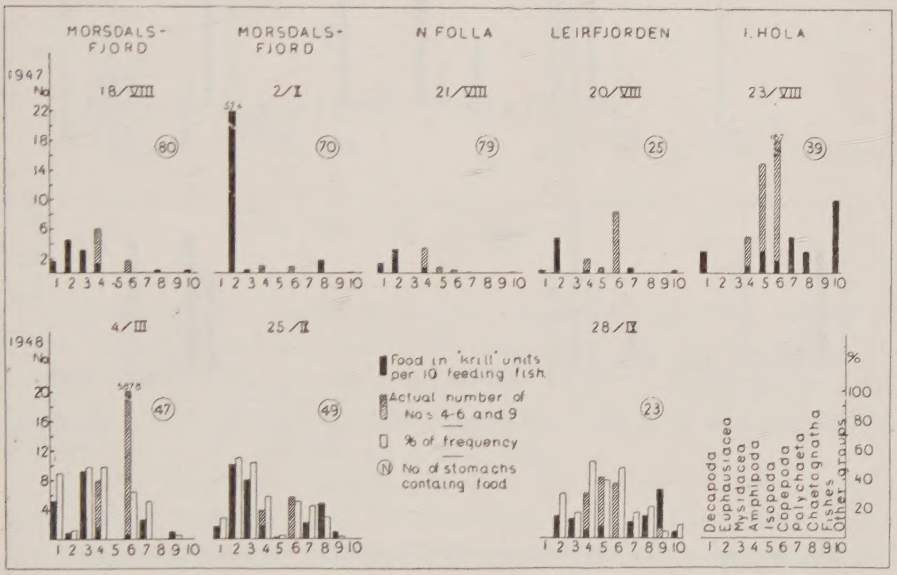

Fig. 2. The food of cod of the 0-group in the Lofoten area during 1947—1948.

Euphausiacea form the main part of the food, the dominating species being *Thysanoëssa inermis*. In Nordfolla and Leirfjord this species was replaced by *Meganyctiphanes norvegica*.

Mysidacea come second to the Euphausiacea. *Erythrops serrata* was the only species occuring.

Amphipoda are frequent and numerous. Many different species occur, but they are all of a very small size. Isopoda are scarce, while the Copepoda are very numerous. In March a large number of *Idya ensifera* occurred in Morsdalsfjord, numbering up to 800 specimens per individual stomach.

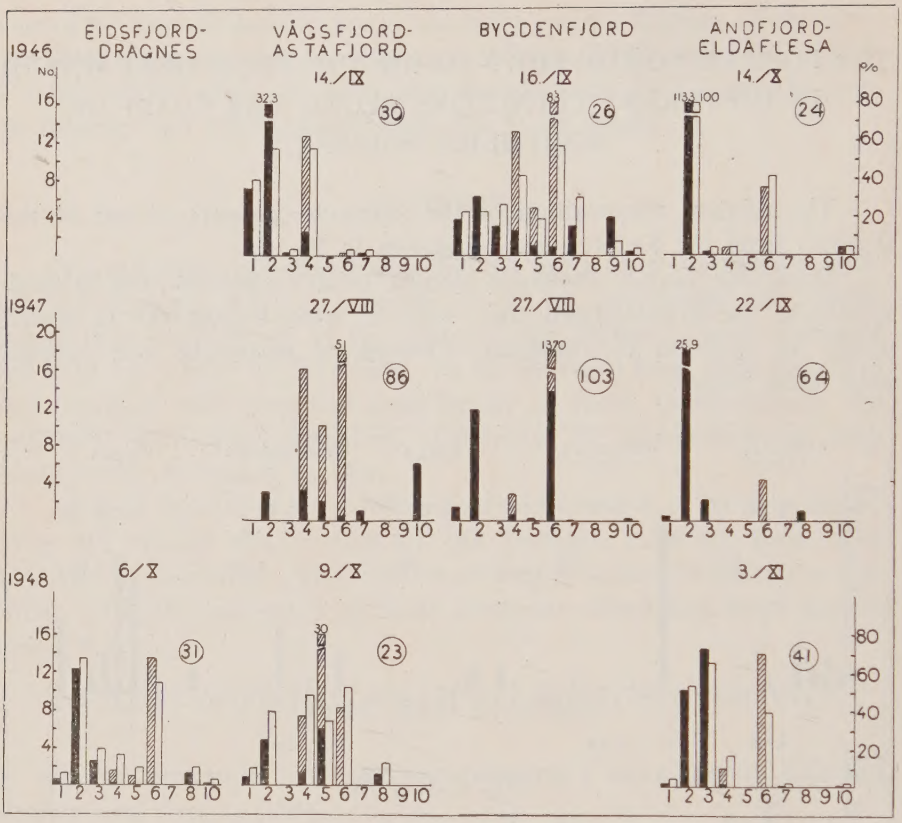

Fig. 3. The food of cod of the 0-group in the Andfjord area during 1947—1948. Symbols as in fig. 2.

Sagitta sp. and Polychaeta occur regularly in small numbers.

Fish are seldom met with. One must assume that the species present at the sea-bottom are on an average too large to be caught by cod of the 0-group.

In the Andfjord area (fig. 3) the Euphausiacea are found in greater quantities than in the Lofoten area, at some stations forming the only food of the cod. Decapoda and Mysidacea are scarce, though *Pandalus borealis* was of some importance in Vågsfjord—Astafjord in 1946, and *Erythrops* at Eldaflesa in 1948.

Amphipoda were numerous at Eldaflesa and Vågsfjord. In 1946 *Themisto abyssorum* was the main species in Vågsfjord, but otherwise no single species dominated.

Eurycope cornuta was the only isopod occurring. It formed the main food of the cod in Vågsfjord in 1948.

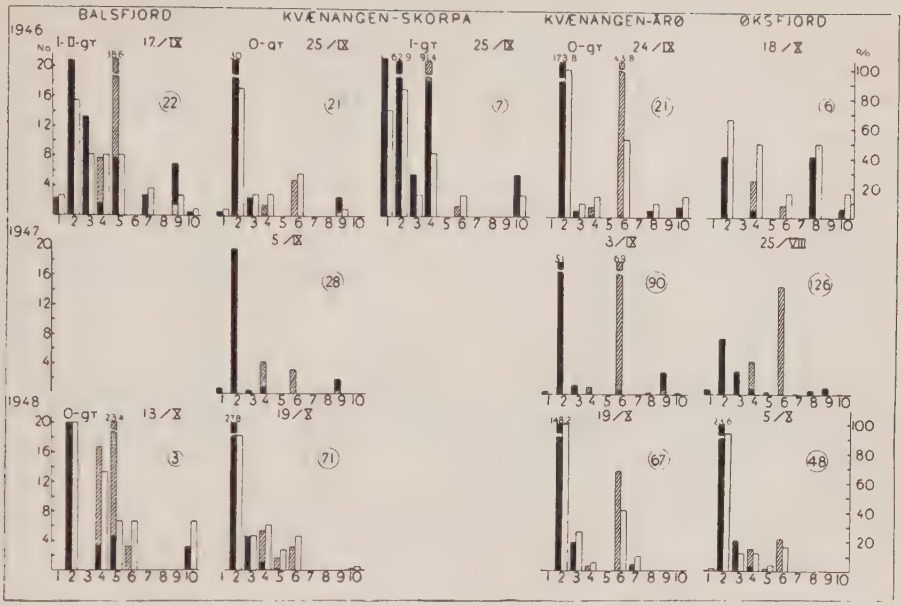

Fig. 4. The food of cod of the 0-II-groups in the Balsfjord—Kvænangen area during 1946—1948. Symbols as in fig. 2.

Copepoda were always numerous, the most important species as a rule being *Undinopsis similis*, *U. bradyi* and *Chiridius armatus*, all bottom forms. *Calanus finmarchicus* also occurred regularly, in 1947 being the most important food organism in Bygdenfjord, averaging 137 specimens per stomach.

In the Balsfjord—Kvænangen area (fig. 4) cod of the 0-group have mainly euphausiids in their stomachs. In addition only a few *Erythrops serrata* and bottom copepods were found. *Calanus finmarchicus* occurred in some number in the Øksfjord in 1947.

Cod of the I—II groups also feed mainly on euphausiids, but *Pandalus borealis* and the amphipods *Halirages fulvocinctus* and *Rachotropis macropus* are of some importance. In Balsfjord *Erypthrops serrata* and *Eurycope cornuta* were numerous.

In the Ulsfjord area (fig. 5) the Mysidacea dominate. In the inner part (Sørfjord) we find mainly *Michteimysis mixta* and *Erythrops serrata*. In the outer fjord *Pseudomma frigidum* and *Erythrops erytrophtalma* also occurred. The isopod *Eurycope cornuta* is numerous in the outer fjord (see also table II and III). Copepods were numerous on some occasions, the main species being *Calanus finmarchicus* and *Undinopsis similis*. The cod of the I-group have eaten more euphausiids, and fish are of some importance as food, occurring in 30 % of the stomachs.

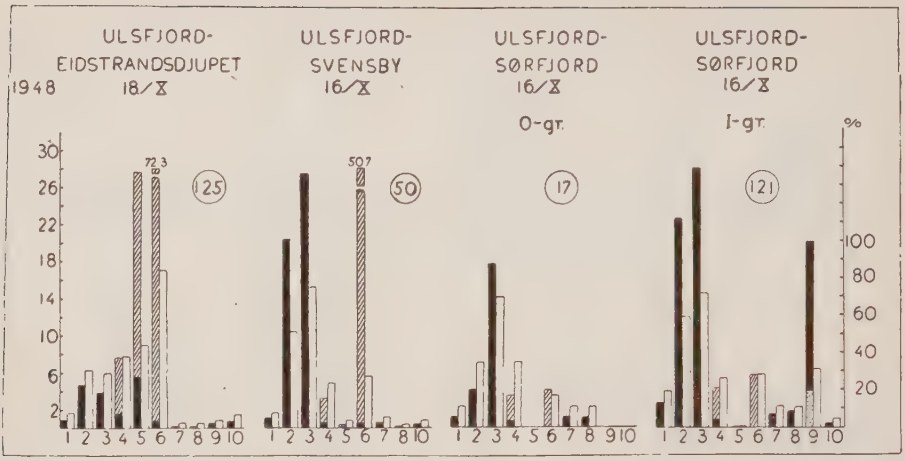

Fig. 5. The food of cod of the 0-II-groups in the Ulsfjord, October 1948. Symbols as in fig. 2.

The fish were quite large, one of them averagely balancing 25 euphausiids.

In the northernmost fjords (fig. 6) the diet of the 0-group of cod is similar to that of the other areas, with the euphausiids as the main food. In the Porsangerfjord *Meganyctiphanes norvegica* was the leading species in 1948.

The average composition of the stomach contents of the 0-group of cod from different areas is shown in fig. 7. Euphausiids are predominant and the other groups are of minor importance, though in 1947 the mysids played a certain part. Copepods are numerous, but of little significance because of their small size.

THE FOOD SPECIES.

Decapoda. *Pandalus borealis* is the most common species. More rarely we find *Pandalus propinquus*, *Pontophilus norvegicus*, *Sabinea sarsi*, and different species of *Spirontocaris* and *Pagurus*. In 1947 *Munida* larvae were frequent.

The Decapoda are of greater importance in cod of the I—II groups than of the 0-group. Only rarely is more than one specimen found per stomach.

Euphausiacea. *Thysanoëssa inermis* is present at practically all stations and is nearly always numerous. *Meganyctiphanes norvegica*

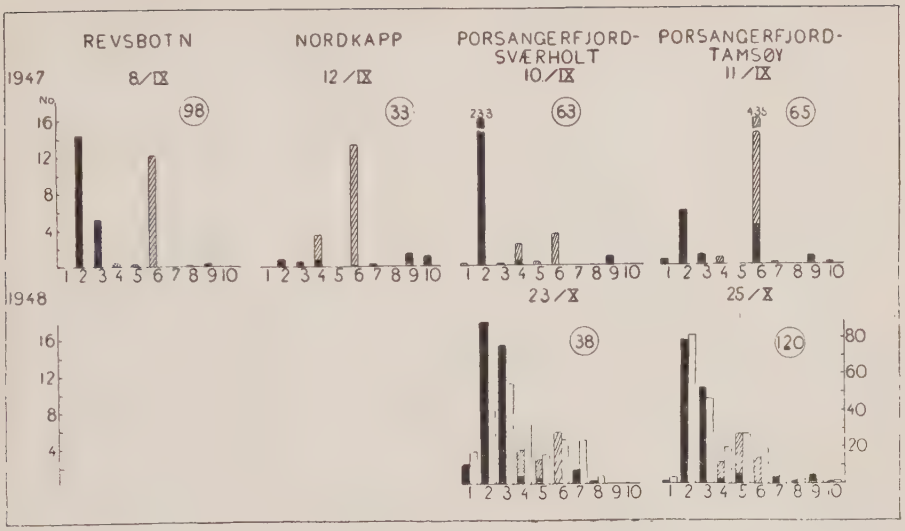

Fig. 6. The food of cod of the 0-group in the Nordkapp area during 1947—1948. Symbols as in fig. 2.

is more scarce but occasionally substituting *T. inermis*. *Thysanoëssa raschi* is met with on a few occasions.

Mysidacea. *Erythrops serrata* is the most important species, in 1947 present at 11 stations (out of 15), in 1948 at 11 stations (out of 16). *Erythrops erythrophtalma* occurred at a few stations and was numerous in the middle part of the Ulsfjord in 1948 and 1949.

Michteimysis mixta was abundant in the northernmost fjords, especially the Sørfjord. — *Pseudomma frigidum* occurred only in Ulsfjord and Porsangerfjord, but was quite numerous in 1948.

Amphipoda. At least 50 different species have been identified, but most of them were small and occurred singly on one or two occasions. Of the larger species the most important were *Themisto abyssorum*, *Halirages fulvocinctus* and *Rachotropis macropus*. *Themisto libellula* and *T. compressa* also occurred. Of the smaller amphipods *Monoculodes packardi* and *Ischyrocerus megacheir* were most often found.

Isopoda. The only species of importance is *Eurycope cornuta* which occurred frequently and in some localities in large numbers.

Copepoda. Calanoid copepods were on some occasions very numerous, 130 or more specimens per stomach. Commonly they were less abundant, averaging 17 specimens per stomach. The species were: *Calanus finmarchicus*, *Pseudocalanus elongatus*, *Undinopsis similis*, *U. bradyi* and *Chiridius armatus*. Less frequent were *Calanus hyper-*

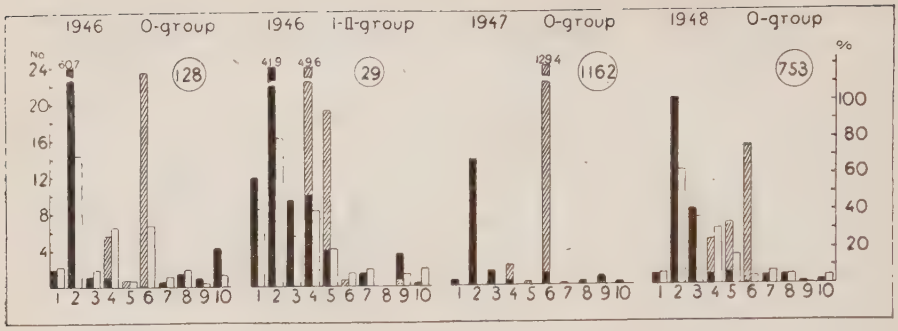

Fig. 7. The food of cod of the 0-II-groups in deep water in some localities of Northern Norway during 1946—1948, average values. Symbols as in fig. 2.

boreus, *Metridia longa*, and some other species. Harpacticids occurred frequently in small numbers, but on one occasion more than 800 *Idya ensifera* were found in one stomach.

Polychaeta and **Chaetognatha** (*Sagitta* sp.) formed a small though constant proportion of the diet of the small cod.

As mentioned above fish are seldom met with, mainly occurring in the stomachs of cod of the I—II group. The species identified were as follows: *Lumpenus maculatus*, *Hippoglossoides platessoides*, *Clupea harengus* and *Cottus* sp. »Other groups« comprise forms occurring more rarely, most often Cumacea.

PELAGIC AND BOTTOM FOOD SPECIES.

It is known that Euphausiacea, *Themisto abyssorum*, *Sagitta elegans*, *Calanus finmarchicus* and *C. hyperboreus* at times are found very close to the sea-bottom. (Russell 1928 and 1933, Somme 1934 and others). As it would be of some interest to know if the small cod caught these organisms immediately above, or at some distance from the sea-bottom, I have divided the food organisms found in the stomachs into »pelagic« species, which comprise the above mentioned groups, and »bottom« organisms.

For the year 1948 the cod of the 0-group were divided into 3 groups, the cod which had eaten exclusively »pelagic« food, those which had eaten »bottom« food only and finally those which had eaten both. It was then found, that of 918 cod, 233 specimens had eaten exclusively »pelagic« food, 282 specimens had eaten »bottom« food and 403 specimens a combination of both groups. It must therefore be assumed

that the »pelagic« animals eaten by the cod have been mainly taken close to the sea-bottom.

It may be noted, that for the most part the organisms eaten by the cod are fast-moving animals.

Fish play a greater part in the diet of the cod of the I—II group, than of those of the 0-group.

VOLUME OF STOMACH CONTENTS.

There were great variations in the volumes of the stomach contents, from 0.1 ml to 4.4 ml per 10. stomachs. This may partly be ascribed to a different intensity in feeding, partly that the feeding has taken place some time ago and the stomach content is well digested. One must bear in mind, however, that cod coming from deep water very often vomit a smaller or greater part of the stomach content during capture, and we may find cod with the stomachs turned inside out. Thus the volume measured in many cases will be smaller than the actual content. It is therefore difficult to decide to what extent feeding takes place in the different localities.

All the hauls have been made during the day.

SUMMARY.

An analysis has been made of the stomach contents of cod, chiefly of the 0-group, some also of the I—II groups from deep water in some fjords in North Norway during the years 1946—1949. The cod were all caught in the period August—November, except for single samples from March and May.

The cod were found to feed almost exclusively on Euphausiacea, mainly *Thysanoëssa inermis*. In some places the Mysidacea were also important, chiefly *Erythrops serrata* and *Michteimysis mixta*. More locally other food species may be of importance, such as Decapoda (*Pandalus borealis*), Amphipoda (*Rachotropis macropus* and *Halirages fulvocinctus*), Isopoda (*Eurycope cornuta*), Copepoda (*Calanus finmarchicus, Undinopsis similis,* Harpacticoida), fish (*Lumpenus maculatus* and others). Decapoda and fish play a greater part as food of cod of the I—II groups than of the 0-group.

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Table I.

The stomach content of cod of the 0—II group from some trawling grounds in Northern Norway. March, September and October 1946.

A. No. of food organisms per 10 stomachs.
B. Frequency percentage of the food organisms.
C. No. of food organisms per individual stomach.

Locality	Date	Average length of cod in millimetres	No. of stomachs containing food	No. of empty stomachs		Decapoda	Euphausiacea	Mysidacea	Amphipoda	Isopoda	Copepoda	Polychaeta	Chaetognatha	Fishes	Other groups
					A	7.0	32.3	0.3	12.7	—	0.3	0.3	—	—	—
Vågsfjord. Astafjord ..	14/IX	82.00	30	0	B	40.0	56.8	3.3	56.8	—	3.3	3.3	—	—	—
					C	1.8	5.8	1.0	2.2	—	1.0	1.0	—	—	—
					A	3.8	6.2	3.1	13.1	5.0	83.0	3.1	—	0.8	0.4
Bygdenfjord	16/IX	81.19	26	1	B	23.1	23.1	27.1	42.3	19.2	57.6	30.8	—	7.7	3.8
					C	1.7	2.7	1.1	3.0	2.6	14.3	1.0	—	1.0	1.0
					A	—	113.3	0.4	0.8	—	7.1	—	—	—	0.8
Andfjord. Eldaflesa	14/X	80.28	24	0	B	—	100.0	4.2	4.2	—	41.7	—	—	—	4.2
					C	—	11.3	1.0	2.0	—	1.7	—	—	—	2.0
		162.00			A	2.3	20.9	13.2	7.7	38.6	—	2.7	—	1.4	0.5
Balsfjord ..... I and II group	17/IX	244.00	22	0	B	13.6	77.3	40.9	40.9	40.9	—	18.4	—	13.6	4.5
					C	1.7	2.7	3.2	1.9	9.4	—	1.5	—	1.0	1.0
					A	0.5	30.0	2.4	1.4	—	4.8	—	—	0.5	—
Kvænangen, Skorpa 0-group	25/IX	79.50	21	8	B	4.8	85.8	14.3	14.3	—	28.6	—	—	4.8	—
					C	1.0	3.5	1.7	1.0	—	1.7	—	—	1.0	—
					A	21.4	62.9	5.7	91.4	—	1.4	—	—	—	5.7
Kvænangen. Skorpa I-group	25/IX	170.00	7	1	B	71.5	85.7	14.3	42.9	—	14.3	—	—	—	14.3
					C	3.0	7.3	4.0	21.3	—	1.0	—	—	—	4.0
					A	—	173.8	0.95	1.4	—	43.8	—	0.95	—	1.4
Kvænangen. Årø 0-group	24/IX	86.69	21	0	B	—	100.0	9.5	14.3	—	52.5	—	9.5	—	14.3
					C	—	17.4	1.0	1.0	—	8.4	—	1.0	—	1.0
					A	—	8.3	—	5.0	—	1.7	—	8.3	—	1.7
Øksfjord	18/X	84.00	6	0	B	—	66.5	—	50.0	—	16.7	—	50.0	—	16.7
					C	—	1.1	—	1.0	—	1.0	—	1.6	—	1.0
			Mean		A	1.9	60.7	1.2	5.7	0.8	23.5	0.6	1.5	0.2	4.3
0-group	total		values		B	11.3	72.0	9.7	30.3	3.2	33.4	5.7	9.9	2.1	6.5
					C	1.5	7.0	1.2	1.7	2.6	4.7	1.0	1.3	1.0	1.3
			Mean		A	11.9	41.9	9.5	49.6	19.3	0.7	1.4	—	0.7	3.1
I and II-group.....	total		values		B	42.6	81.5	27.6	41.9	20.5	7.2	9.2	—	6.8	9.4
					C	2.4	5.0	3.6	11.6	9.4	1.0	1.5	—	1.0	2.5

Table II.

The stomach content of cod of the 0-group from some trawling grounds in Northern Norway. August—October 1947.

No. of food organisms per 10 stomachs.

Locality	Date	Average length of cod in millimetres	No. of stomachs containing food	No. of empty stomachs	Ml. of food per 10 stomachs	Decapoda	Euphausiacea	Mysidacea	Amphipoda	Isopoda	Copepoda	Polychaeta	Chaetognatha	Fishes	Other groups
Morsdalsfjord	18/VIII	79.28	80	5	0.4	1.6	4.5	3.1	6.0	—	1.7	0.1	0.4	—	0.4
Morsdalsfjord	2/X	88.84	70	0	1.7	0.1	57.4	0.4	1.0	—	0.9	—	1.7	—	0.1
Leirfjorden	20/VIII	81.41	25	2	0.8	0.4	4.8	—	2.0	0.8	8.4	0.8	—	—	0.4
Nordfolla	21/VIII	81.34	79	10	0.8	1.3	3.2	—	3.4	0.8	0.4	0.1	—	—	0.1
Høla	23/VIII	71.11	39	15	0.1	0.3	—	—	0.5	1.5	16.7	0.5	0.3	—	1.0
Vågsfjord. Astafjord	27/VIII	83.70	86	19	0.1	—	0.3	—	1.6	1.0	5.1	0.1	—	—	0.6
Bygdenfjord	27/VIII	80.02	103	2	0.6	1.4	11.7	—	2.8	0.3	1370.0	0.1	—	—	0.3
Eldaflesa	22/IX	88.88	64	4	1.6	0.5	25.9	2.3	—	—	4.4	—	1.1	—	—
Ulsfjord. Sørfjord	2/IX	75.12	113	12	0.6	1.4	5.2	7.1	1.1	—	112.5	0.3	1.9	0.5	—
Kvænangen. Skorpa	5/IX	88.15	28	2	1.1	0.7	19.5	0.4	4.3	—	3.2	—	—	0.4	—
Kvænangen. Årøy	3/IX	85.89	90	1	1.0	0.4	51.0	1.3	1.1	—	69.0	—	0.3	0.6	0.2
Øksfjord	25/VIII	74.11	126	10	0.5	0.7	7.7	3.2	4.5	0.4	14.7	0.1	0.6	0.2	0.1
Refsbotn	8/IX	87.99	98	4	0.6	0.1	14.5	5.3	0.6	0.4	12.3	—	0.2	0.1	—
Nordkapp	12/IX	80.64	33	9	0.1	—	0.9	0.6	3.5	—	13.3	0.3	—	0.3	1.2
Porsangerfjord. Tamsøy	11/IX	82.33	65	12	0.2	0.6	6.0	1.2	0.9	—	435.0	0.3	—	0.2	0.3
Porsangerfj. Sværholt	10/IX	89.60	63	16	0.4	0.2	23.3	0.3	2.4	0.4	3.5	—	—	0.2	—
		Total	1162	Mean values	0.7	0.6	13.8	1.6	2.2	0.4	129.4	0.2	0.4	0.2	0.3

Table III.

The stomach content of cod of the 0-I group from some trawling grounds in Northern Norway. March and September—November 1948.

A. No. of food organisms per 10 stomachs of feeding fish.
B. Frequency percentage of the food organisms.
C. No. of food organisms per individual stomach.

Locality	Date	Average length of cod in millimetres	No. of stomachs containing food	No. of empty stomachs	Ml. of food per 10 stomachs		Decapoda	Euphausiacea	Mysidacea	Amphipoda	Isopoda	Copepoda	Polychaeta	Chaetognatha	Fishes	Other groups
						A	5.1	0.9	9.1	7.9	—	587.8	2.6	—	0.2	—
Morsdalsfjord	4/III	126.32	47	3	11.1	B	44.7	6.4	49.0	49.0	—	32.0	25.6	—	2.1	—
						C	1.1	1.3	1.9	1.6	—	184.0	1.0	—	1.0	—
						A	1.6	10.0	8.0	3.9	0.2	5.7	2.2	4.9	0.2	—
Morsdalsfjord	25/IX	87.54	49	19	0.4	B	14.6	55.0	53.0	28.6	2.1	26.5	22.4	14.6	2.1	—
						C	1.1	1.8	1.5	1.3	1.0	2.1	1.0	3.4	1.0	—
						A	—	3.5	2.6	6.1	8.3	7.4	2.2	3.0	1.3	0.9
Leirfjord	28/IX	74.58	23	39	—	B	—	30.2	17.4	52.2	39.2	47.8	17.4	21.8	4.8	8.7
						C	—	1.1	1.5	1.2	2.1	1.5	1.2	1.4	3.0	1.0
						A	0.6	12.3	2.6	1.6	1.0	13.5	—	1.3	—	0.3
Eidsfjord. Dragnes	6/X	84.07	31	9	0.2	B	6.5	67.7	19.8	16.2	9.7	54.8	—	9.7	—	3.2
						C	1.0	1.8	1.3	1.0	1.0	2.4	—	1.3	—	1.0
						A	0.9	4.8	—	7.4	30.0	8.3	—	1.3	—	—
Vågsfjord. Astafjord ...	9/X	81.31	23	5	0.4	B	8.7	39.2	—	47.8	34.8	52.2	—	13.0	—	—
						C	1.0	1.2	—	1.5	8.6	1.6	—	1.0	—	—
						A	0.5	10.2	14.6	2.0	—	14.1	0.2	—	—	0.2
Eldaflesa	3/XI	80.91	41	7	0.3	B	4.9	53.7	65.8	17.1	—	39.0	2.4	—	—	2.4
						C	1.0	1.0	2.2	1.1	—	3.6	1.0	—	—	1.0
						A	—	20.0	—	16.7	23.4	3.3	—	—	—	3.3
Balsfjord	13/X	91.67	3	2	2.3	B	—	100.0	—	66.7	33.4	33.4	—	—	—	33.4
						C	—	2.0	—	2.5	7.0	1.0	—	—	—	1.0

Table III (cont.).

Locality	Date	Average length of cod in millimetres	No. of stomachs containing food	No. of empty stomachs	Ml. of food per 10 stomachs		Decapoda	Euphausiacea	Mysidacea	Amphipoda	Isopoda	Copepoda	Polychaeta	Chaetognatha	Fishes	Other groups
Kvænangen. Skorpa ...	19/X	90.85	71	3	1.3	A	—	27.8	4.6	5.4	1.7	3.2	—	—	—	0.3
						B	—	91.5	23.9	31.0	14.1	23.9	—	—	—	2.8
						C	—	3.0	2.0	1.7	1.2	1.3	—	—	—	1.0
Kvænangen. Årø	19/X	95.21	67	0	4.4	A	—	148.2	3.9	0.7	—	13.6	1.0	—	—	—
						B	—	100.0	26.9	6.0	—	43.2	10.5	—	—	—
						C	—	14.8	1.4	1.2	—	3.2	1.0	—	—	—
Øksfjord. Øyneshavn ..	5/X	70.25	48	2	0.8	A	0.2	23.6	4.2	3.1	0.4	5.4	—	—	—	—
						B	2.1	93.7	12.5	12.5	4.2	16.7	—	—	—	—
						C	1.0	2.5	3.3	2.5	1.0	3.2	—	—	—	—
Ulsfjord. Eidstrandsdjup.	18/X	95.11	125	2	1.0	A	0.8	4.6	3.8	7.6	27.6	72.3	0.2	0.2	0.1	0.7
						B	8.0	31.2	29.6	38.4	44.8	85.0	2.4	2.4	0.8	7.2
						C	1.0	1.5	1.3	2.0	6.2	8.5	1.0	1.0	1.0	1.0
Ulsfjord. Svensby	16/X	80.83	50	1	1.5	A	1.0	23.6	27.4	3.2	0.4	50.7	0.6	0.2	—	0.4
						B	8.2	52.0	76.0	24.0	4.0	28.0	6.0	2.0	—	4.0
						C	1.2	4.5	3.6	1.3	1.0	18.0	1.0	1.0	—	1.0
Ulsfjord. Sørfjord ..... (0-gr)	16/X	76.88	17	2	0.7	A	1.2	4.1	17.6	3.5	—	4.1	1.2	1.2	—	—
						B	11.8	35.2	70.5	35.2	—	17.6	11.8	11.8	—	—
						C	1.0	1.1	2.5	1.0	—	2.3	1.0	1.0	—	—
Ulsfjord. Sørfjord ..... (I-gr)	16/X	166.55	121	3	0.7	A	2.6	22.4	27.8	4.2	0.1	5.6	1.4	1.7	3.9	0.4
						B	19.0	59.5	72.0	26.4	0.8	28.1	11.6	10.7	31.4	4.1
						C	1.3	3.7	3.9	1.6	1.0	2.0	1.2	1.6	1.2	1.0
Porsangerfjord. Sværholt	23/X	94.00	38	3	—	A	2.1	17.7	15.3	3.7	2.6	15.5	1.6	0.3	—	—
						B	18.5	39.5	60.5	34.2	15.8	23.7	15.8	3.8	—	—
						C	1.0	4.3	2.5	1.1	1.7	2.3	1.0	1.0	—	—
Porsangerfjord. Tamsøy	25/X	89.72	120	6	0.7	A	0.3	15.8	10.6	2.4	5.5	2.8	0.7	0.3	0.2	0.2
						B	3.3	81.8	46.7	20.0	27.5	19.2	5.0	3.3	1.7	1.7
						C	1.0	1.9	2.3	1.2	2.0	1.5	1.3	1.0	1.0	1.0
	0-group Total 706* Mean values*				1.2	A	0.7	23.3	8.2	4.8	7.2	15.0	0.9	0.9	0.1	0.5
						B	6.2	62.2	35.9	30.7	16.4	3.7	6.7	5.2	0.7	4.5
						C	0.7	4.5	1.8	1.5	2.3	3.8	0.7	0.9	0.4	0.6

* Except Morsdalsfjord in March and the I-group in the Ulsfjord.

Table IV.

The stomach content of cod from two localities in Ulsfjord, Northern Norway. May 13th 1949.

No. of food organisms per 10 stomachs.

Locality	Length of cod in millimetres	No. of stomachs	Decapoda	Euphausiacea	Mysidacea	Amphipoda	Isopoda	Copepoda	Polychaeta	Fishes	Other groups
Jøvik	115—168	23	—	10.4	56.1	2.2	0.9	3.9	1.3	0.9	0.4
Eidstrandsdyp	110—137	7	—	1.4	10.0	2.9	52.9	11.4	7.1	—	—
Eidstrandsdyp	166—168	3	*Pandalus borealis* 1-1-2 per stomach, resp.								

Table V.

The food of cod of the 0-II group from some deep fjords in Northern Norway 1946—1949.

	Morsdalsfjord	Leirfjord	Nordfolla	Høla	Eidsfjord	Vågsfjord, Astafjord	Bygdenfjord	Andfjord	Balsfjord	Ulsfjord, Sørfjord	Ulsfjord, Svendsby	Ulsfjord, Eidstrandsdyp	Kvænangen, Skorpa	Kvænangen, Årøy	Øksfjord	Refsbotn	Nordkapp	Porsangerfjord, Tamsøy	Porsangerfjord, Sværholdt
MEDUSAE:																			
Medusae remains	× ?	×		× ?								?					× ?		× ?
CHAETOGHATHA:																			
Sagitta sp.	×	×		×	×	×		×		×	×	×		×	×	×		×	×
TUNICATA:																			
Oikopleura sp.	×																		
MOLLUSCA	×	×					×							×					
POLYCHAETA	×	×	×	×		×	×	×		×	×	×					×	×	×
COPEPODA:																			
Calanus finmarchicus (GUNN)	×	×	×	×	×	×	×	×		×		×	×	×	×	×	×	×	×
Calanus hyperboreus KRÖYER	×	×			×	×				×		×	×		×	×			
Pseudocalanus elongatus (BOECK)	×						×												
Pseudocalanus gracilis?												× ?							
Undinopsis bradyi G. O. SARS	×		×	×	×		×			×				×	×				
Undinopsis similis G. O. SARS	×			×				×			×			×				×	×
Chiridius armatus (BOECK)						×	×	×				×	×	×					
Bryaxis brevicornis BOECK							×												
Pareuchaeta norvegica (BOECK)												×							
Xanthocalanus borealis G. O. SARS		×			×														
Oothrix borealis n. sp.												×	×	×				×	×
Scolecithricella minor BRADY				×						×									
Diaixis hibernica (A. SCOTT)		×			×							×							
Stephos scotti G. O. SARS					×			×						×	×				
Parastephos pallidus G. O. SARS	×	×						×				×			×			×	

Table V (cont.).

	Morsdalsfjord	Leirfjord	Nordfolla	Høla	Eidsfjord	Vågsfjord, Astafjord	Bygdenfjord	Andfjord	Balsfjord	Ulsfjord, Sørfjord	Ulsfjord, Svendsby	Ulsfjord, Eidstrandsdyp	Kvænangen, Skorpa	Kvænangen, Ároy	Øksfjord	Refsbotn	Nordkapp	Porsangerfjord, Tamsøy	Porsangerfjord, Sværholdt
Tharybis macrophtalma G. O. SARS				×		×													
Temora longicornis MÜLLER	×														×				
Metridia longa (LUBBOCK)	×				×	×			×	×		×	×		×		×	×	
Metridia lucens BOECK							×												
Oithona helgolandica CLAUS															×				
Bradypontius major G. O. SARS																			
Scottomyzon sp.					×														
Cyclopoida indet.	×						×	×					×		×			×	
Idya minor SCOTT	×																		
Idya ensifera FISCHER	×																		
Harpacticoida indet.	×		×	×		×		×		×					×		×	×	
Cerviniopsis sp.					×		×												
Monstrilla sp.						×	×												
Copepoda indet.					×														
CUMACEA:																			
Hemilamprops uniplicata G. O. SARS																×	×		
Eudorella emarginata (KRÖYER)	×	×							×		×	×	×					×	
Diastylis rostrata (GOODSIR)											×		×						
Diastylis rathkei (KRÖER)													×						
Cumacea indet.	×				×					×			×	×				×	
OSTRACODA:			×			×	×			×					×				
ANOMURA:																			
Eupagurus sp.	×											×							
Galathea sp.							×	×		×			×	×	×			×	×
Munida sp.	×		×																×

Table V (cont.).

	Morsdalsfjord	Leirfjord	Nordfolla	Høla	Eidsfjord	Vågsfjord, Astafjord	Bygdenfjord	Andfjord	Balsfjord	Ulsfjord, Sørfjord	Ulsfjord, Svendsby	Ulsfjord, Eidstrandsdyp	Kvænangen, Skorpa	Kvænangen, Årøy	Øksfjord	Refsbotn	Nordkapp	Porsangerfjord, Tamsøy	Porsangerfjord. Sværholdt
MYSIDACEA:																			
Erythrops erytrophtalma (Goes)	× ?							× ?						×					
Erythrops serrata (G. O. Sars)	×	×			×		× ?	×	×	×	× ×	×	× ×		×	×	×	× ×	× ×
Erythrops sp.																			
Michtheimys mixta (Lilljeborg)									× ×	×	×		×					× ×	
Stilomysis grandis (Goes)									×										
Pseudomma truncatum (S. J. Smith)													×						
Pseudomma frigidum Hansen										×		×						× ×	
Praunus inermis (Rathke)											×		× ×						
Mysidacea indet.					×	×		×					×						
EUPHAUCIACEA:																			
Meganyctiphanes norvegica M. Sars		/	/			/		×	× ×										
Thysanoëssa inermis (Kröyer)	×				×	×	×	×		× ×	×	× ×	× ×	× ×	× ×	× ×	×	× ×	× ×
Thysanoëssa raschi (M. Sars)	× ?									× ×	×			×					
Nematobrachion boopis (Calman)								×											
DECAPODA																			
Pandalus borealis Kröyer	×		/		/	/	×	×	×	× ×	× ×	×	×	×	×	×		× ×	×
Pandalus propinquus G. O. Sars	×																		
Leander serratus (Pennant)													/						
Pandalina brevirostris (Calman	×												/					×	
Spirontocaris lilljeborgi (Hansen)											×	×	×						
Spirontocaris polaris Scott										× ×									
Pontophilus norvegicus (M. Sars)	×	/								× ×								×	× ×
Sabinea sarsii Smith	×		/				/				×								×
AMPHIPODA:																			
Themisto abyssorum Boeck	×	/	×		×	/	/			×		×	×		×	×		×	
Themisto libellula (Mandt)			×			×									×				
Themisto compressa Goës			×																

Table V (cont.).

	Morsdalsfjord	Leirfjord	Nordfolla	Hola	Eidsfjord	Vågsfjord, Astafjord	Bygdenfjord	Andfjord	Balsfjord	Ulsfjord, Sørfjord	Ulsfjord, Svendsby	Ulsfjord, Eidstrandsdyp	Kvænangen, Skorpa	Kvænangen, Årøy	Øksfjord	Refsbotn	Nordkapp	Porsangerfjord, Tamsøy	Porsangerfjord, Sværholdt
Hyperia medusarum (MÜLLER)						×							× ?					×	
Scina borealis G. O. SARS	×																	×	
Hippomedon propinquus G. O. SARS	×						×				×								
Orchomenella sp.	×																		
Anonyx nugax (PHIPPS)	×																		
Hoplonyx acutus G. O. SARS	×																		
Centromedon pumilus (LILLJEBORG)	×																	×	
Centromedon sp.																			
Chironesimus Debruynii (HOEK)	×																		
Phoxocephalus holbölli (KRÖYER)							×												
Harpinia propinqua G. O. SARS		×	×			×													
Harpinia abyssi G. O. SARS						×													
Harpinia sp.						×													
Ampelisca eschrichtii KRÖYER							×												
Andania abyssi BOECK	×											×	×						
Andaniella pectinata G. O. SARS							×												
Amphilocus tenuimanus BOECK																			
Gitanopsis inermis G. O. SARS				×				×											
Stenothoe brevicornis G. O. SARS	×																		
Metopa boecki G. O. SARS	×																		
Metopa borealis G. O. SARS											×								
Monoculodes tessellatus SCHNEIDER	×																		
Monoculodes borealis BOECK										×									
Monoculodes longirostris (GOES)										×									
Monoculodes packardi BOECK	×									×					×			×	×
Monoculodes tenuirostratus BOECK								×		×									
Monoculodes sp.	×	×												×					
Halimedon mülleri BOECK											×								
Bathymedon longimanus (BOECK)					×														
Bathymedon obtusifrons (HANSEN)										×									
Aceros phyllonyx (M. SARS)	×									×								×	

Table V (cont.).

	Morsdalsfjord	Leirfjord	Nordfolla	Høla	Eidsfjord	Vågsfjord, Astafjord	Bygdenfjord	Andfjord	Balsfjord	Ulsfjord, Sørfjord	Ulsfjord, Svendsby	Ulsfjord, Eidstransdyp	Kvænangen, Skorpa	Kvænangen, Arøy	Øksfjord	Refsbotn	Nordkapp	Porsangerfjord, Tamsøy	Porsangerfjord, Sværholdt
Syrrhoë crenulata Goes																			×
Tiron acanthurus Lilljeborg														×					
Rachotropis macropus G. O. Sars	×	×	×			×			×			×	×			×			×
Haliragoides inermis G. O. Sars																			
Halirages fulvocinctus (M. Sars)	×	×	×		×			×	×	×			×	×	×			×	×
Apherusa bispinosa (Sp. Bate)						×													
Melita dentata Kröyer										×									
Melita sp.	×																		
Eriopisa elongata (Bruzel)		×	×																
Lilljeborgia sp.																	×		
Idunella æquicornis G. O. Sars																		×	
Gammaropsis erytrophtalma Lilljeborg	×																		
Gammaropsis melanops G. O. Sars			× ?			× ?	×												
Ischyrocerus megacheir (Boeck)	×									×									
Chorophium bonelli M. Edw.														×				×	
Lætmatophilus armatus (Norm.)							×												
Dulichia curticauda Boeck	×																		
Dulichia falcata S. Bate	×																		
Paradulichia typica Boeck																			
Amphipoda indet.		×				×				×	×				×	×		×	×
ISOPODA:																			
Janira maculosa Leach			×																
Munna sp.			×																
Ilyarachna hirticeps G. O. Sars		×																	
Eurycope cornuta G. O. Sars		×			×				×			×			×	×		×	×
Tanaidae		×		×															
Gnathia oxyurea (Lilljeborg)		×	×	×	×		×				×								
Isopoda indet.																			
PYCNOGONIDA:												×							

Table V (cont.).

	Morsdalsfjord	Leirfjord	Nordfolla	Høla	Eidsfjord	Vågsfjord, Astafjord	Bygdenfjord	Andfjord	Balsfjord	Ulsfjord, Sørfjord	Ulsfjord, Svendsby	Ulsfjord, Eidstrandsdyp	Kvænangen, Skorpa	Kvænangen, Årøy	Oksfjord	Refsbotn	Nordkapp	Porsangerfjord, Tamsøy	Porsangerfjord, Sværholdt
CIRRIPEDIA:																			
Balanus cypris								×										×	
PISCES:																			
Cottus sp.									×										
Lumpenus maculatus FRIES									×	×				×	×			×	
Hippoglossoides platessoides FABR.	×	×																	
Clupea harengus L.										× ?									
Pisces indet.									×				×				×	×	

APPENDIX.

Oothrix borealis n. sp., a bottom-dwelling copepod from Northern Norway.

During the examination of stomach contents from cod of the 0—II group from some fjords in Northern Norway a copepod was found which proved to be a new species. This copepod was near related to *Oothrix bidentata* FARRAN (FARRAN 1905) which it resembled in many respects, but was much smaller, from 1.75 millimetres to 2.15 millimetres, while *O. bidentata* is 3.0 millimetres. There were also some other differences which are described below.

The female (fig. 1 b) has a rather ovate body, last segment on each side ending in a double spine (fig. 2 b). The cephalothorax ends in a bifurcate rostrum (fig. 3) protruding downwards. Cephalon is not separated from the first thorax segment. The edge of the 3 lower segments of the urosome (fig. 4 b) is clothed with small spinules, like those figured by FARRAN (1905) in *Brachycalanus*. The genital segment is of the same length as the two following segments combined. The spines of the furcal rami (fig. 4 c) are clothed with long fine hairs.

First antenna (fig. 5) is 24-jointed, reaching last segment of the cephalothorax. The ratios between the segments are as follows:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
14.	8.	4.	3.	3.	3.	4.	9.	4.	3.	3.	4.	4.	5.	5.	4.	4.	5.	5.	5.	6.	6.	6.	4.

The second antenna and the maxilla (fig. 6—7) resemble those of *O. bidentata*. The mandible has a cutting edge (fig. 8) with fewer spines than in *O. bidentata*. First maxillipede (fig. 9) has 7 terminal sensory filaments of hairlike shape. Second maxillipede (fig. 10) as in *O. bidentata*. The lack of spines on the inner joint is probably due to the bad state of the copepods, having been eaten by the cod. Natatory legs 1—4 are similar to those of *O. bidentata*. Only the first leg has been drawn (fig. 11). Fifth pair of legs (fig. 12) is almost identical with that of the type species, but all three joints are setose on the outer margin.

The male (fig. 1 a) is of the same length as the female, but somewhat more slender, and the lateral spines of the last segment (fig. 2 a) are less prominent. The urosome (fig. 4 b) is of the same length as that of the female, with the same proportions between the last three segments. Fifth pair of legs (fig. 13) well developed. Both rami are of about equal length. The second joint of the right leg has a styliform appendage on the inner side.

Following M. Rose (1933) I place the genus *Oothrix* Farran within the family Phaennidae. In *O. borealis* the fusion of the two first segments of the cephalothorax and the presence of a rostrum show the relation to *Xanthocalanus* Giesbrecht. The fifth pair of legs of the male shows much resemblance with the corresponding legs of *Xanthocalanus borealis* Sars.

A few males and females of *O. borealis* were found in the stomachs of young cod caught in some fjords in Northern Norway during the years 1946—49. The exact positions were: Kvænangen, 69° 47' 6" N, 21° 57' 2" E, Ulsfjord, 69° 52' 8" N, 19° 58' 6" E, and Porsangerfjord, 71° 0' 7" N, 26° 28' 0" E. The depths varied between 196 metres and 270 metres. At all localities the bottom was muddy.

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PLATE I.

Fig. 1. *Oothrix borealis* n. sp. a, male, b, female.
Fig. 2. Last segment, a, male, b, female.
Fig. 3. Rostrum.
Fig. 4. Urosome, a, male, b, female.
Fig. 5. First antenna.

PLATE II.

Fig. 6. Second antenna.
Fig. 7. Maxilla.
Fig. 8. Mandible.
Fig. 9. First maxillipede.
Fig. 10. Second maxillipede.

PLATE III.

Fig. 11. First natatory leg.
Fig. 12. Fifth pair of legs, female.
Fig. 13. Fifth pair of legs, male.

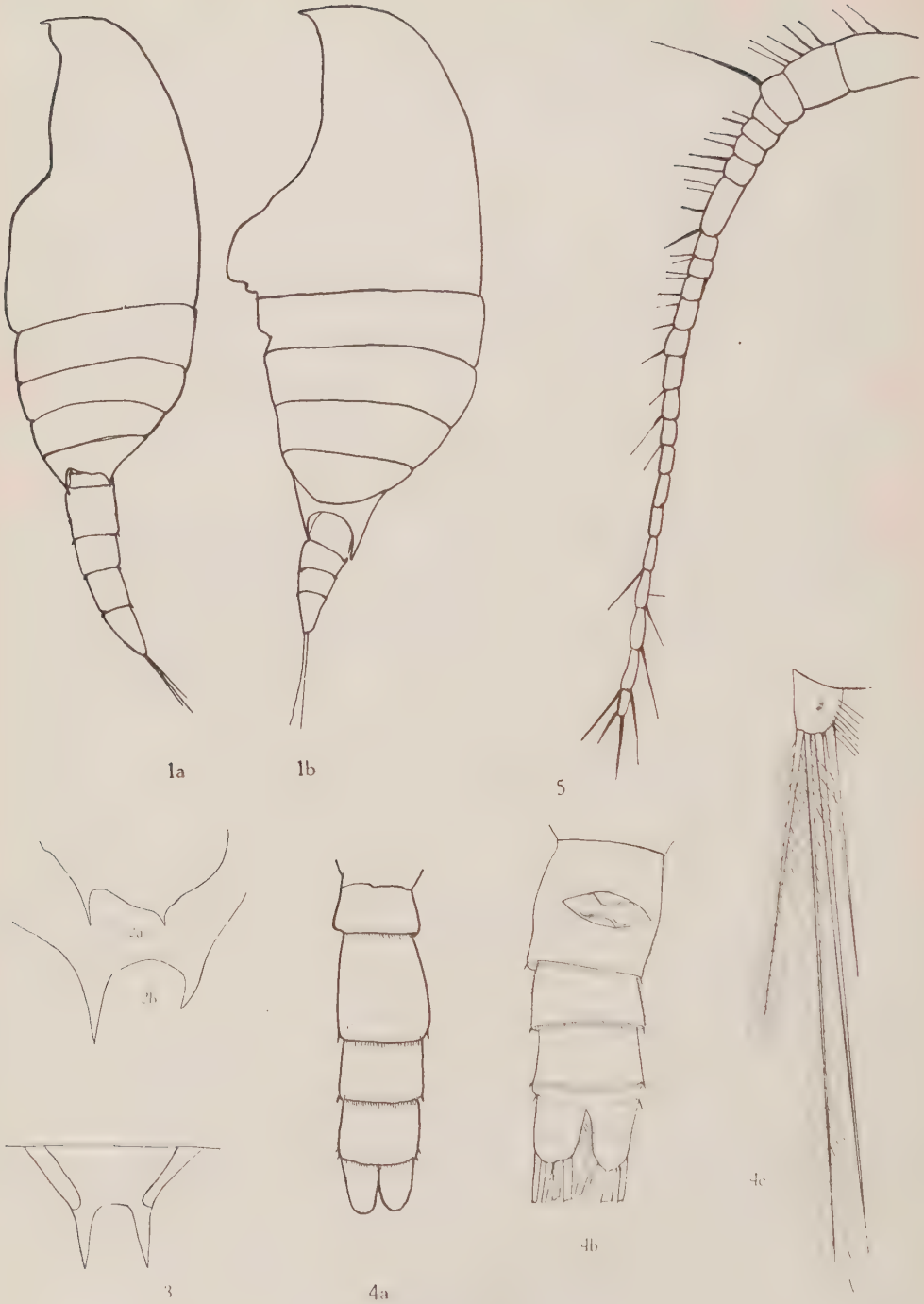
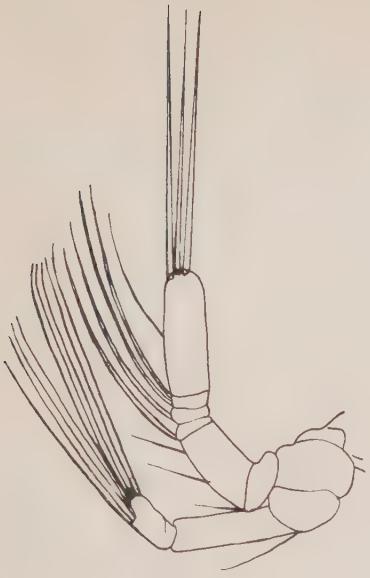


PLATE I.



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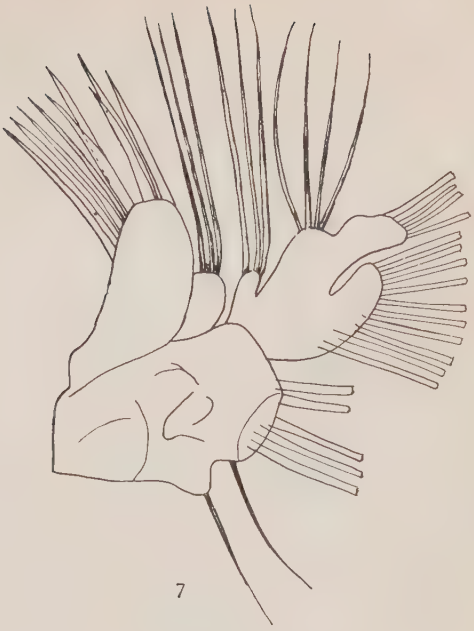

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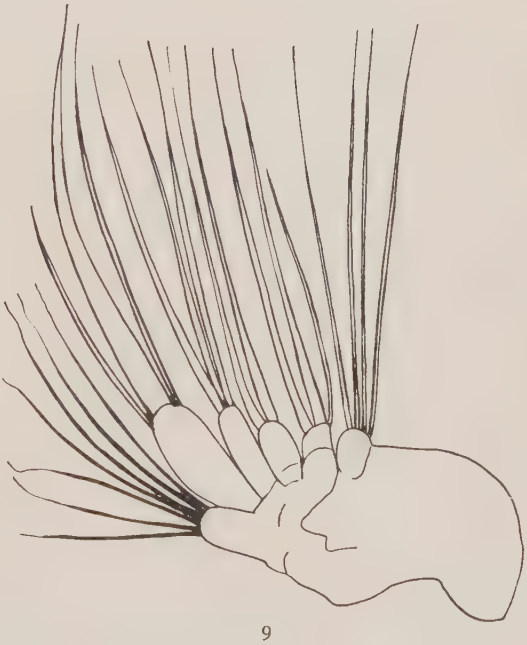

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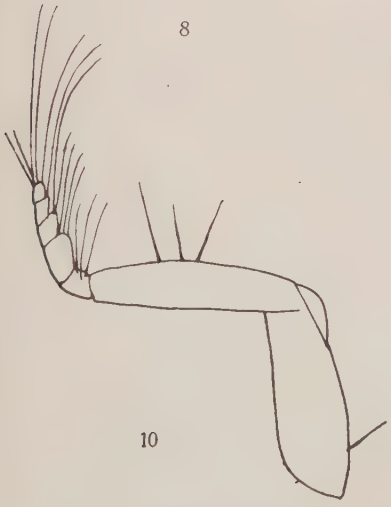

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PLATE II.

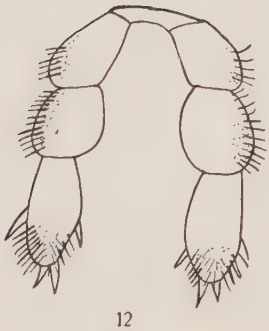

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PLATE III.